Name: ______________________________ Date: ________________

Polynomial Operations SOLUTION (version 130)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 5x^5 + 8x^4 - 6x^3 + 4x - 3$$

$$q(x) = -x^5 - 5x^3 - 8x^2 - 3x + 7$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$p(x) = (5)x^5 + (8)x^4 + (-6)x^3 + (0)x^2 + (4)x^1 + (-3)x^0$$
$$q(x) = (-1)x^5 + (0)x^4 + (-5)x^3 + (-8)x^2 + (-3)x^1 + (7)x^0$$
$$p(x) + q(x) = (4)x^5 + (8)x^4 + (-11)x^3 + (-8)x^2 + (1)x^1 + (4)x^0$$
$$p(x) + q(x) = 4x^5 + 8x^4 - 11x^3 - 8x^2 + x + 4$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -3x^2 - 5x - 4$$

$$b(x) = -6x - 9$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-3x^2$	$-5x$	-4
$-6x$	$18x^3$	$30x^2$	$24x$
-9	$27x^2$	$45x$	36

$$a(x) \cdot b(x) = 18x^3 + 30x^2 + 27x^2 + 24x + 45x + 36$$

Combine like terms.

$$a(x) \cdot b(x) = 18x^3 + 57x^2 + 69x + 36$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 130)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{array}{rcl} f(x) & = & 7x^3 - 24x^2 - 17x - 4 \\ g(x) & = & x - 4 \end{array}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-4}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 7 & -24 & -17 & -4 \\ 4 & & 28 & 16 & -4 \\ \hline & 7 & 4 & -1 & -8 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 7x^2 + 4x - 1 + \frac{-8}{x-4}$$

In other words, $h(x) = 7x^2 + 4x - 1$ and the remainder is $R = -8$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 7x^3 - 24x^2 - 17x - 4$. Evaluate $f(4)$.

You could do this the hard way.

$$\begin{array}{rcl} f(4) & = & (7)\cdot(4)^3 \; + \; (-24)\cdot(4)^2 \; + \; (-17)\cdot(4) \; + \; (-4) \\ & = & (7)\cdot(64) \; + \; (-24)\cdot(16) \; + \; (-17)\cdot(4) \; + \; (-4) \\ & = & (448) \; + \; (-384) \; + \; (-68) \; + \; (-4) \\ & = & -8 \end{array}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(4)$ equals the remainder when $f(x)$ is divided by $x - 4$. Thus, $f(4) = -8$.